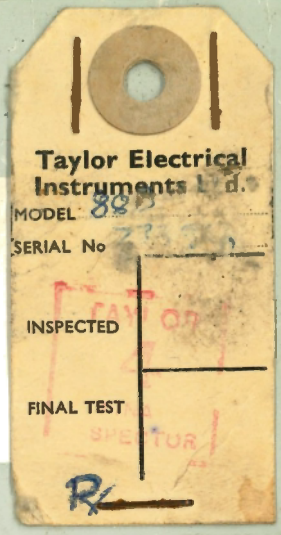

TAYLOR MULTIRANGE METER MODEL 88B

INSTRUCTION MANUAL

TAYLOR ELECTRICAL INSTRUMENTS LIMITED
419-424, MONTROSE AVENUE SLOUGH · BUCKS · ENGLAND
Telephone: SLOUGH 21381 *Telegrams: TAYLINS, SLOUGH*

Instruction Manual

for

TAYLOR

MULTIRANGE METER

Model 88B

EDUSTAJA-GENERALAGENT
HAVULINNA Oy
HELSINKI-HELSINGFORS
Vuorik. 16 A Bergg.
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TAYLOR MULTI-RANGE METER MODEL 88B

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1. GENERAL DESCRIPTION

1.1 GENERAL

The Model 88B is a robust multi-range instrument of high sensitivity, which will be found ideal for voltage measurements in high resistance circuits, laboratory and research work, television repairs and in other electronic fields.

The 6 inch mirror scale is easy to read on all ranges. Ranges are selected by a large, positive action switch located in the centre of the panel and is used in conjunction with the function switch.

The Model 88B meter incorporates an automatic mechanical overload switch as a protection against overload on all ranges. A meter reverse switch is also incorporated to facilitate easy push-button change over on d.c. voltage and current ranges.

1.2 METER

The meter movement fitted in the Model 88B is a Taylor "Large Centre Pole" fitted with a knife edge pointer.

The meter has a full scale deflection of 37·5 microamperes and a coil resistance of approximately 1·7 kΩ. It is a robust movement fitted with spring mounted jewelled bearings and a varnish impregnated coil.

The meter is designed to withstand normal use in both bench and field work, but like all miniature assemblies, should be handled with reasonable care to ensure a long and trouble free life.

1.3 SCALES

The Model 88B has 6 scales. The outer green scale is calibrated in ohms and is used on the 5 resistance ranges. The second, a black linear scale numbered 0—25 is used for voltage and current measurements in multiples of 2·5.

The anti-parallax mirror ensures accurate pointer alignment with all scales. The third black linear scale situated below the mirror and numbered 0–10 0–50, is used for voltage and current measurements in multiples of 1 and 5. The fourth and fifth black scales are for capacitance and inductance measurements see (4.1). The sixth bottom red scale calibrated −10dB to +22dB is used for output measurements in decibels at a reference 0dB=1mW into 600 ohms.

1.4 CONTROLS

The centre control knob operates the range selector switch. This selects the VOLTAGE CURRENT or RESISTANCE range desired.

The right hand knob is the zero ohms adjust potentiometer which compensates for the variation of battery voltage and enables the meter pointer to be set at "0" ohms before making resistance measurements.

The left hand knob operates the Function switch which selects the appropriate circuit for either a.c., d.c. or resistance measurements.

The left hand push button is a meter reverse switch with a "push to reverse" action for a normal d.c. input. This switch has been incorporated to simplify the matter of lead alteration when direction of current may be reversed. The switch is normally set for positive meter deflection with the correct polarity marked on the terminals.

The right hand push button is the cut-out reset button and is pushed down to reset the cut-out mechanism.

1.5 TERMINALS

There are six clearly marked terminals on the Model 88B.

The black negative test lead is connected to the negative (−) terminal for all measurements.

The red positive test lead is connected to the positive (+) terminal for all measurements with the exception of 2,500 volts a.c., 2,500 volts d.c., 10 A a.c. and 10 A d.c. These ranges have separate terminals marked with their respective titles.

1.6 CUT-OUT

An attractive feature of the Model 88B is the provision of an automatic cut-out, which gives a very high degree of overload protection to the whole of the instrument.

The negative input circuit is broken if an overload is applied, and the cut-out reset button springs from its normal position on the panel giving an indication to the operator that an overload has taken place.

The cut-out reset button has then to be pressed down to reset the trip mechanism. Before resetting however, the input leads should be disconnected or the fault which caused the overload rectified.

The cut-out is tripped by the meter moving coil actuating the release mechanism beyond the full scale position of the pointer. Provision is made for a similar trigger action below the zero end of the scale so that overloads in either direction are catered for.

The cut-out is not guaranteed to protect the instrument against all types of serious overload or the worst cases of misuse. Mains voltage applied to low current ranges or variable supplies exceeding any ranges at which the instrument has been set, and introduced progressively, may also damage the meter or components. It should be borne in mind that the successful operation of the cut-out depends on the impact of the coil on the trigger mechanism. Circuit components have been deliberately over-rated to allow a generous measure of protection in such cases.

Severe mechanical shock will also trip the cut-out mechanism.

2. PERFORMANCE SPECIFICATION

2.1 TABLE OF RANGES

D.C. Voltage	A.C. Voltage	D.C. Current	A.C. Current
0·1	1·0	50μA*	1mA
0·25	2·5	100μA	2·5mA
1·0	5·0	250μA	5mA
2·5	10·0	1mA	10mA
5·0	25·0	2·5mA	25mA
10·0	50·0	5mA	50mA
25·0	100	10mA	100mA
50·0	250	25mA	250mA
100·0	500	50mA	500mA
250·0	1kV	100mA	1A
500	2·5kV	250mA	10A
1000		500mA	
2500		1A	
25kV†		10A	

Decibels (0dB=1mW into 600 Ω)	Resistance	Capacitance†	Inductance†
−10 to +22	1 to 5kΩ	0·001 to 01μA	0·2 to 20H
−4 to +28	10 to 50kΩ	0·01 to 1μF	2·0 to 200H
+4 to +36	100 to 500kΩ	0·1 to 10μF	
+10 to +42	1KΩ to 5MΩ	1·0 to 100μF	
+16 to +48	10KΩ to 50MΩ		
+24 to +56			
+30 to +62			
+36 to +68			

* on 0·1V d.c. range

†using external adaptor

2.2 SENSITIVITY

20,000 ohms per volt on all d.c. ranges
2,000 ohms per volt on range 0—25V a.c. and upwards
200 ohms per volt on the 0—10V a.c. range
100 ohms per volt on the 0—5 and 0—2·5V a.c. ranges
40 ohms per volt on the 0—1V a.c. range

2.3 ACCURACY

2% of f.s.d. on d.c. voltage ranges up to 1,000V
6% of f.s.d. on d.c. voltage ranges up to 0—2,500V
3% of f.s.d. on a.c. voltage ranges except 0—25V range
4% of f.s.d. on a.c. voltage ranges up to 0—25V
2% of f.s.d. on d.c. current ranges
2% of f.s.d. on a.c. current ranges

2.4 FREQUENCY RESPONSE

On a.c. voltage ranges the frequency response is substantially flat within ±3% up to 100 kc/s.

2.5 DISTORTED WAVEFORM

The 88B like all rectifier meters, measures the mean value of the a.c. voltage applied, and is scaled in the r.m.s. value for a sinusoidal waveform. A distorted waveform will cause inaccurate readings, and the user should therefore recognise the possibilty of error when using distorted waveforms, squarish waveshapes produce high readings and peaky ones low readings.

3. OPERATING INSTRUCTIONS

3.1 GENERAL

It is advisable to switch off power to the circuits under test before connecting or disconnecting the meter test leads. Where it is not practicable, the operator is advised to use extreme care in checking high voltages. Where the voltage to be measured is not known, the 88B should be switched to the highest range and the instrument then switched down until a reasonable deflection is obtained on the meter. Greater accuracy is obtained when the pointer is nearest its full scale reading.

3.2 ZERO ADJUSTMENT

Before taking readings, ensure that the meter pointer is set at zero. Adjust by means of the slotted bakelite screw located in the centre of the front panel below the meter dial.

3.3 D.C. VOLTAGE MEASUREMENTS 0—1,000 VOLTS

(*a*) Set the Function switch to d.c. voltage.

(*b*) Rotate the range selector switch to the voltage range required (when in doubt select the highest range).

(*c*) Connect the black negative test lead to the negative (−) terminal and the red positive lead to the positive (+) terminal. Connect the free ends of the test leads across supply to be measured, observing correct polarity.

(*d*) Switch on power and read the voltage on the two black linear scales numbered 0—10, 0—25 or 0—50. For actual voltage measured multiply or divide the indicated reading on the meter by reference to either 0—10, 0—25 or 0—50 scales determined by the range switch setting: e.g., 25 volts d.c. will be indicated by a full scale reading on 0—25 scale with range selector at 25 volts, or 25 volts d.c. will be indicated by a reading of 2·5 on the 0—10 scale with the range switch set at 100 volts.

3.4 D.C. VOLTAGE MEASUREMENTS 1,000—2,500 VOLTS

CAUTION: Use extreme care when checking high voltages:

(*a*) Set Function switch to d.c. voltage.

(*b*) Rotate the range selector switch to 1,000 volts.

(*c*) Black (−) lead should be connected to the negative (−) terminal, and the red (+) lead connected to the 2,500 v d.c. terminal.

(*d*) Switch on power and read the black scale numbered 0—25. For actual voltage measured multiply reading obtained by 100.

3.5 A.C. VOLTAGE MEASUREMENTS 0—1,000 VOLTS

(*a*) Set Function switch to a.c. voltage.

(*b*) Rotate the range selector switch to the voltage range required (when in doubt select the highest range).

(*c*) Connect the black test lead to the negative (−) terminal and the red test lead to the positive (+) terminal. Connect the free ends of the test leads across the supply to be measured.

The meter will give a positive deflection on the a.c. voltage ranges irrespective of which way the test leads are applied. It is good practice to connect the negative lead to the earthy side of the supply voltage being measured.

(*d*) Switch on power and take readings, using the black linear scales numbered 0—10, 0—25 or 0—50.

For examples refer to d.c. voltage measurements.

3.6 A.C. VOLTAGE MEASUREMENTS 1,000—2,500 VOLTS

CAUTION: Use extreme care when checking high voltages:

(*a*) Set the Function switch to a.c. voltage.

(*b*) Rotate the range selector switch to 1,000 volts. Connect the black test lead to the negative terminal and the red test lead to the 2,500V terminal. Connect the free ends of the test leads across the supply to be measured.

(*c*) Switch on power and read the black scale numbered 0—25. For actual voltage measured multiply this reading by 100.

3.7 A.C. CURRENT MEASUREMENTS 0—1 AMPERE

(*a*) Set the Function switch to a.c. mA.

(*b*) Rotate the range selector switch to the current range required (when in doubt select the highest range).

(*c*) Connect the black test lead to the negative (−) terminal and the red test lead to the positive (+) terminal. Connect the free ends of the test leads in series with the supply circuit.

The meter will give a positive deflection on the a.c. current ranges irrespective of which way the test leads are connected. It is good practice to connect the negative lead to the earthy side of the supply being measured.

(*d*) Switch on power and take readings.

(*e*) All readings are with reference to the 0—10, 0—25 or 0—50 black linear scales.

3.8 A.C. CURRENT MEASUREMENTS 1—10 AMPERES

(*a*) Set the Function switch to a.c. mA.

(*b*) Rotate the range selection switch to the 1000 position.

(*c*) Connect the black test lead to the negative (−) terminal and the red test lead to the 10A terminal.

(*d*) Connect the free ends of the test leads in series with the supply circuit. Switch on power and read on the black linear scale numbered 0—10.

3.9 D.C. CURRENT MEASUREMENTS 0—1 AMPERE

(*a*) Set the Function switch to "d.c. mA".

(*b*) Rotate the range selector switch to the current range required (when in doubt select the highest range).

(*c*) Connect the black test lead to the negative (−) terminal and the red test lead to the positive (+) terminal.

(*d*) Connect the free ends of the test leads in series with the supply circuit, observing correct polarity. Switch on power and read on the black linear scales numbered 0—10, 0—25 or 0—50.

3.10 D.C. CURRENT MEASUREMENTS 1 to 10 AMPERES

(*a*) Set the Function switch to "d.c.−mA".

(*b*) Rotate the range selector switch to the 1000 position.

(*c*) Connect the black test lead to the negative terminal and the red test lead to the 10 A d.c. terminal.

(*d*) Connect the free ends of the test leads in series with the supply circuit, observing correct polarity. Switch on power and read on the black linear scale numbered 0—10.

3.11 EXTERNAL SHUNTS

The d.c. current ranges of the Model 88B can be extended by means of external shunts and the following procedure should be adopted:

The instrument should be switched to 0·1 volt d.c. and the shunt connected to the positive and negative terminals of the 88B via the mV take-off points incorporated on the shunts. The current to be measured is applied directly to the shunt terminals. The actual value of current measured can be read on the appropriate scale.

3.12 RESISTANCE MEASUREMENTS

CAUTION: Before making resistance measurements make sure that no voltage is present across the components to be measured. An applied voltage when the meter is switched to an ohms range may trip the overload cut-out, or if the external voltage is small, will cause inaccurate resistance measurements. It should be remembered that on all the ohms ranges the battery positive connection is taken to the 88B negative terminal. This may be important because the resistance of some components, e.g., rectifiers and electrolytic capacitors, varies according to the direction of the current through them. Resistance readings therefore depend on the direction in which the test voltage is applied, quite apart from its magnitude.

(*a*) Set the Function switch to "R".

(*b*) Rotate the range selector switch to the ohms range required.

(*c*) Connect the black test lead to the negative terminal and the red lead to the positive terminal.

(*d*) Short the free ends of the test leads and rotate the "Zero Ohms" control until the pointer is set at zero (i.e. f.s.d.) on the ohms scale of the meter. This is the top green scale on the meter dial.

(*e*) Separate the ends of the test leads and connect them across the components to be measured.

(*f*) Read ohms on the top green scale. For actual measurements in ohms, multiply the reading obtained by the multiple on the ohms range markings on the selector switch engraving, e.g., 2,000 ohms measured on the R100 range will give a reading of 20 on the ohms scale.

3.13 UNDERGROUND CABLE FAULT LOCATION

An additional feature of Model 88B (in conjunction with Model 388 adaptor) is the location of suspected open circuits in armoured underground cable. The test should be carried out on one of the capacitance ranges and to obtain the best possible accuracy, all measurements should be made on the same range. Measurements should be made between the cores and armour and d.c. resistances core to core or core to armour must be high.

Let L equal total length of cable.

A and B are distances of damaged points from the ends of cable and is: L=A+B.

Ca—Capacitance of one section of open circuit core measured from one end of cable.

Cb—Capacitance of another section of core measured from another end of cable.

Ct—Capacitance of undamaged core: in case when all cores damaged then approximately

Ct=Ca+Cb.

$$A=\frac{Ca}{Ct}L \text{ or } B=\frac{Cb}{Ct}L$$

3.14 POWER OUTPUT READINGS

An external capacitor should be fitted in series with one of the test leads for a.f. output measurements. This is to block any d.c. voltage present which would otherwise give a meter deflection on the a.c. voltage ranges. A suitable value would be a ·01 μF capacitor at 1,000 voltage d.c. working. This capacitor is then in series with the multiplier resistors on the voltage ranges and will affect slightly the accuracy of the 88B readings, depending on the range selected and the frequency of the applied voltage. This error, however, may be ignored, as most a.f. output measurements are of a comparative nature only.

The power in watts is equal to the voltage squared divided by the resistance of the load. For example, an amplifier may have a rated load of 15 ohms for a loudspeaker voice coil. When the amplifier sets up 4 volts a.c. across a 15 ohms resistor connected to the output, the power is just over 1 watt ($4^2/15=1{\cdot}06$).

3.15 INSTRUMENT LOADING

Any meter connected to a circuit slightly alters the conditions so that its reading does not exactly correspond with what it would be if the meter were not there. This applies to both voltage and current readings and is true of any meter, or for that matter of almost any physical measurement whatsoever.

The important thing is to know whether the effect of the meter is large or small, and this follows from the meter sensitivity. On d.c. voltage its sensitivity is 20,000 ohms per volt, *i.e.* on the 100 volt range 2 megohms. As long as the circuit to which the meter is connected has a resistance of less than 1/100 of this, *viz.* 20,000 ohms, the error will be less than 1 per cent., and usually this is negligible. On a.c. voltages the same calculation applies, except that the sensitivity is 2,000 ohms per volt. except on lower a.c. voltage ranges.

On d.c. current readings the voltage drop depends on the range, but is not more than 0·25 volt. In circuits with a supply voltage of at least 100 times this, *viz.* 25 volts, the error is less than 1 per cent.

3.16 DECIBEL READINGS

Increases or decreases in audio-frequency power can be measured in decibels on the a.c. voltage ranges. The ratio of two powers, P1 and P2, is $10\log_{10}$ P1/P2 decibels, and of the corresponding voltages V1 and V2 is 20 log V1/V2. The reference level is quite arbitrary and in this instrument it is 1 milliwatt into 600 ohms, *i.e.* 0·7746 volt, which is read on the 0—10 volt range. For the other ranges, corrections are made as follows:—

0 dB = 1 mW into 600 ohms
10 volt range add 0 dB
25 volt range add 8 dB
50 volt range add 14 dB
100 volt range add 20 dB
250 volt range add 28 dB
500 volt range add 34 dB
1,000 volt range add 40 dB

4. ADAPTORS

4.1 CAPACITANCE AND INDUCTANCE ADAPTOR

An external adaptor, Model 388, is available for these measurements. This adaptor is suitable for use on 50-cycle a.c. mains of 100–125 volts or 200–250 volts. The adjuster should be screwed firmly into the socket most nearly corresponding to the actual mains voltage, *i.e.*:

For 100–125 volts use the 115 V socket.
For 200–224 volts use the 210 V socket.
For 225–250 volts use the 240 V socket.

Connect the 1 mA a.c. terminals to Model 88B with switches set to 1 mA a.c. Short-circuit the "Capacitance or Inductance" terminals and select the C or H range desired. Then switch on and turn the "Adjust Mains" knob until exactly f.s.d. is obtained. Replace the short with the unknown capacitance or inductance and read the value directly. As with resistance measurements, the best accuracy is obtained by selecting the range which gives most nearly mid-scale deflection. For example, 0·1 μF can undoubtedly be read on the C range, but it can be read much more accurately on the C/10 range. (i.e. 1μF f.s.d.)

4.2 HIGH VOLTAGE ADAPTOR

The Taylor High voltage adaptor, Model 488 may be connected in series with the 2,500 volt d.c. range on the Model 88B to extend the range to 25 kilovolts d.c. Great care should be exercised by the operator in measuring high voltages, to avoid bringing any part of the body near the high voltage point.

TO MEASURE HIGH VOLTAGES WITH NEGATIVE EARTHED:

(*a*) Switch the Model 88B selector switch to the 1,000 volt d.c. range. Set the Function switch to d.c. voltage.

(*b*) Connect the 88B negative terminal to the negative (earthed) supply point by means of the negative test lead.

(*c*) Connect the Model 488 adaptor to the 2,500 Vd.c. terminal of the Model 88B.

(*d*) Hold the probe at the cable end behind the guard, and apply the prod to the high voltage supply point.

TO MEASURE HIGH VOLTAGES WITH POSITIVE EARTHED:

(*a*) Switch the 88B range selector switch to the 1,000 volt d.c. range. The Function switch to d.c. voltage.

(*b*) Connect the 2,500 volt d.c. terminal to the positive (earthed) supply point.

(*c*) Connect the Model 488 adaptor to the negative terminal of the Model 88B.

(*d*) Hold the probe at the cable end behind the guard and apply the prod to the high voltage supply point.

The voltage (in kV) should be read on the black scale marked 0—25.

For measurements in volts multiply readings by 1000.

5. MAINTENANCE

5.1 BATTERY REPLACEMENT

Two batteries are mounted inside the battery compartment of the 88B moulding.

They are EVER READY U2 (1·5V) and B121 (15V) or equivalents. To replace either battery, loosen the two fixing screws of the battery cover and slide the cover until the screw heads locate in the clearance holes.

The cover can now be removed exposing the two battery contact plates. The top contact plates are held in position by spring loaded clips, which should be pushed outwards to release the contact plates. The batteries can now be replaced.

A list of approved replacement components will be found in the table of components.

Guarantee

All Taylor instruments are subject to a very thorough examination and final test, and leave our factory in good condition. Should you receive the instrument damaged please notify us and retain the instrument and *packing* for possible inspection by the carriers.

We guarantee all our instruments against faulty manufacture, and subject to the following terms we will repair, or, at our option, exchange free of charge any defective parts which fail in this instrument within SIX MONTHS from the date of registration. Certain proprietary articles such as Valves, Rectifiers, Cathode Ray Tubes, etc., are covered by separate manufacturers' guarantees and these terms are subject to the conditions imposed by those suppliers.

THE GUARANTEE IS VALID PROVIDED:

1. That the Registration Card has been correctly completed and returned to us within *seven days* of purchase.
2. That the instrument has had, at all times, normal use and has not been tampered with, or modified.
3. The guarantee will apply only if the instrument is bought from Taylor Electrical or an authorized supplier at the appropriate price and terms.
4. That in cases of complaint the instrument is returned to us securely packed, carriage paid.
5. That any faulty parts are returned to us for inspection (if required).
6. In the event of repairs being carried out by the purchaser the Company cannot be held responsible for any expenses incurred. Confirmation should be obtained from us that the guarantee will not be affected should the user wish to correct a minor defect himself.
7. Under no circumstances can the Company be held responsible for indirect damage caused by any defect, loss or damage in transit. Our liability in all cases is limited to making good any defective part of the instrument.
8. This guarantee cannot be varied by any person or company other than Taylor Electrical Instruments Ltd. In the event of any dispute arising as to the interpretation of this guarantee, the decision of theCompany must be accepted as final.

GUARANTEE FOR VALVES AND CATHODE RAY TUBES

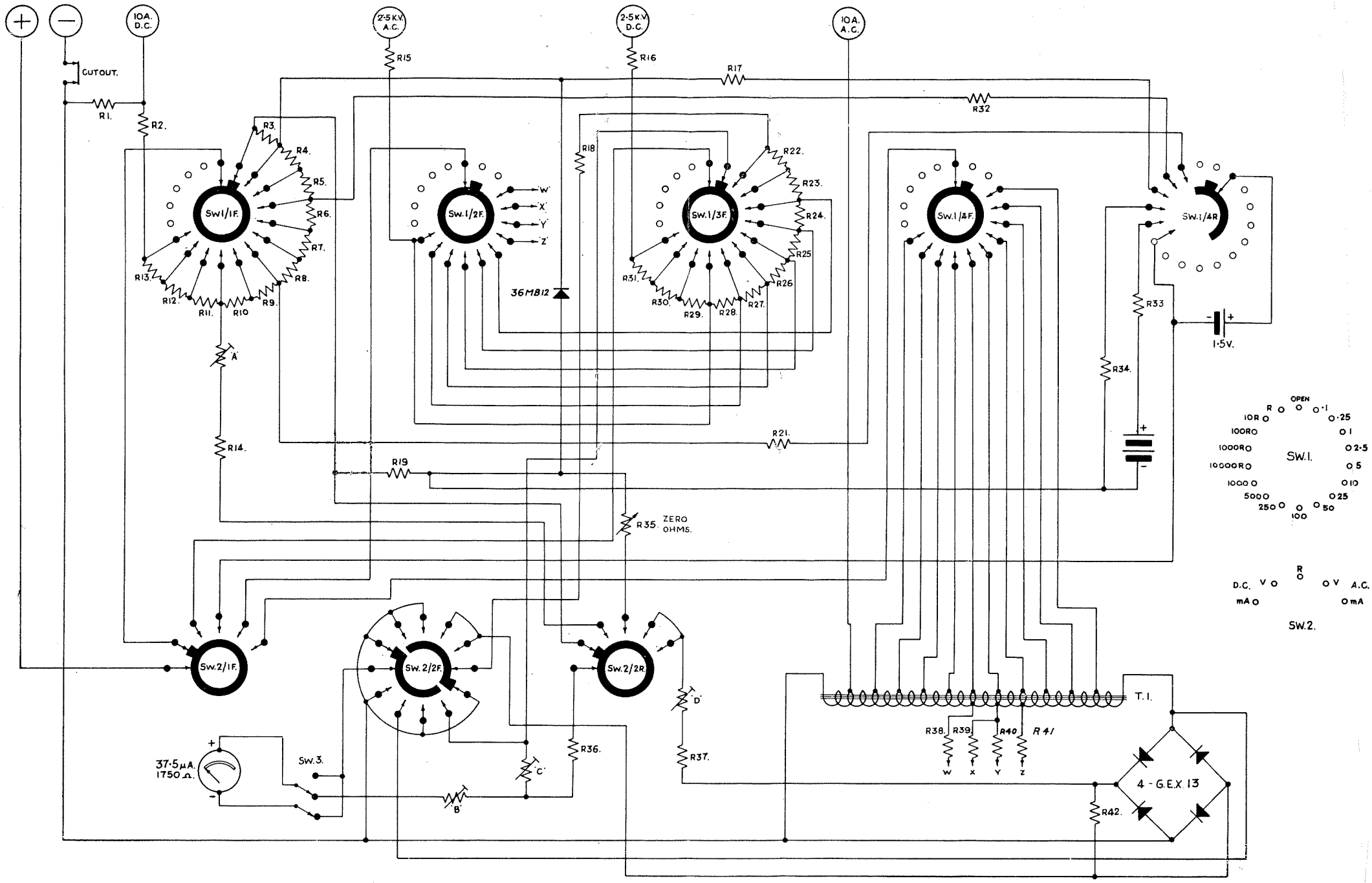
NOTE: Valves are guaranteed by the majority of manufacturers for a period of three months from the date of purchase and is only given in respect of faulty workmanship and/or material and does not cover misuse, consequential damage or breakage.

TAYLOR ELECTRICAL INSTRUMENTS LIMITED
419-424 MONTROSE AVENUE · SLOUGH · BUCKS · ENGLAND

CCT REF	VALUE	PART NO.
R.1	0·025Ω	740200
R.2	0·225Ω	830534
R.3	1500Ω	115202
R.4	750Ω	175101
R.5	150Ω	115102
R.6	50Ω	150002
R.7	25Ω	125001
R.8	15Ω	115005
R.9	5Ω	830535
R.10	2·5Ω	830536
R.11	1·5Ω	830537
R.12	0·5Ω	830538
R.13	0·25Ω	830539
R.14	3000Ω	130201
R.15	3MΩ	130506
R.16	30MΩ	130604
R.17	1470Ω	115203
R.18	3000Ω	130201
R.19	7500Ω	175202
R.20	1000Ω	110208
R.21	14Ω	114001
R.22	15kΩ	115303
R.23	30kΩ	130302
R.24	50kΩ	150301
R.25	100kΩ	110405
R.26	300kΩ	130402
R.27	500kΩ	150401
R.28	1MΩ	110504
R.29	3MΩ	130501
R.30	5MΩ	150505
R.31	10MΩ	110606
R.32	140Ω	114101
R.33	236kΩ	124401
R.34	20kΩ	120305
R.35	3750Ω pot	710096
R.36	2070Ω	121201
R.37	2200Ω	122201

CCT REF	VALUE	PART NO.
R.38	15·7Ω	116002
R.39	89Ω	189001
R.40	188Ω	119103
R.41	900Ω	190101
R.42	600Ω	160102
Rect.	36MB12	740129
Rect.	GEX13	740058
S.W.1.	Range Selector Switch	700106-1
S.W.2.	Function Switch	70098-3
S.W.3	Meter Reverse Switch	700120
S.W.4	Cut-out Switch	660681
A	2000Ω Slider	740201
B	1000Ω Slider	740202
C	1000Ω Slider	740202
D	1000Ω Slider	740202

Item No.	DESCRIPTION	PART NO.
1	Terminals	830846
2	Terminal Base	660935
3	Front Panel	660794
4	Case Moulding	660454
5	Battery Compartment	830348-1
6	Battery Cover Plate	500661
7	Large Knob	660472
8	Small Knob	660451
9	Meter Zero Pip	660006
10	Meter Glass	660471
11	Test Leads	830360
12	Ever Ready U2 (1·5 volts)	740067
13	Ever Ready B121 (15 volts)	740087
14	Carrying Handle	660158
15	Reverse Switch Button	660934
16	Cut-out Reset Button	660464
17	Meter Cover Moulding	660706
18	Feet	660941
19	Moulded Bezel (white)	660776
20	Front Panel Complete with Items 9, 10 and 19	830542
21	Movement and Scaleplate Complete with Item 20	830688



5.3 CIRCUIT DIAGRAM OF TAYLOR MODEL 88B

Chiltern Printers (Slough) Ltd. Kelpatrick Road, Slough